



566.40319X00
Response Under 37 CFR 1.116
Expedited Procedure
Group No. 2813

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants: T. UCHIDA, et al.
Application No.: 09/869,347
Filed: September 7, 2001
For: MATERIALS FOR POLISHING LIQUID FOR METAL,
POLISHING LIQUID FOR METAL, METHOD FOR
PREPARATION THEREOF AND POLISHING METHOD USING
THE SAME
Art Unit: 2813
Examiner: L. M. Schillinger

REQUEST FOR RECONSIDERATION
AFTER FINAL REJECTION

Mail Stop AF
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

March 31, 2004

Sir:

In response to the Office Action mailed October 31, 2003, Applicants respectfully request reconsideration of the Final rejection of claims 1-55, under 35 USC §102(e) as being anticipated by the teachings of U.S. Patent No. 5,770,095 to Sasaki, et al., and respectfully submit that all of the claims now presented for consideration by the Examiner patentably distinguish over the teachings of the reference applied by the Examiner in rejecting claims in the Office Action mailed October 31, 2003, that is, the teachings of Sasaki, et al., under the requirements of 35 USC §102 and 35 USC §103.

It is respectfully submitted that the reference as applied by the Examiner would have neither taught nor would have suggested such a metal-polishing liquid material as in the present claims, including an oxidized-metal etchant and a protective film-forming agent, and wherein this liquid material further includes a dissolution promoter for the protective film-forming agent. See claim 1.

In addition, it is respectfully submitted that the applied reference would have neither disclosed nor would have suggested such a liquid material as discussed previously with reference to claim 1, and in particular, wherein the material further includes at least one of an oxidizing agent and water. See claim 2.

Furthermore, it is respectfully submitted that the applied reference would have neither taught nor would have suggested such liquid material as in the present claims, including the ingredient group consisting of the recited components including the protective film-forming agent and the dissolution promoter, and wherein the ingredient group is in a divided state of two constituent elements not mixed. See claim 3.

Moreover, it is respectfully submitted that the applied reference would have neither disclosed nor would have suggested such liquid material as in the present claims, including wherein the dissolution promoter is a surfactant (note, e.g., claims 4 and 42); more specifically, wherein such dissolution promoter is such surfactant as set forth in, e.g., claims 5 and 43.

Furthermore, it is respectfully submitted that the applied reference would have neither disclosed nor would have suggested such liquid material as in the present claims, having features as set forth previously in connection with claim 1, and wherein the dissolution promoter is a solvent, having solubility for the protective film-

forming agent, as in, for example, claims 6, 9, 44, 46 and 47; and/or wherein the dissolution promoter is a solvent and is selected from the group consisting of alcohols, ethers and ketones (note, e.g., claims 8 and 45).

Attention is particularly directed to claims 40-45, further defining the protective film-forming agent and the dissolution promoter. Particularly with respect to these claims, it is respectfully submitted that the applied reference of Sasaki, et al. would have neither disclosed nor would have suggested the features of the present invention recited therein.

In addition, it is respectfully submitted that the applied reference would have neither disclosed nor would have suggested such metal-polishing liquid material as in the present claims, wherein at least part of the protective film-forming agent is solid, having a mean particle size of at most 100 μm . See claim 10.

Moreover, it is respectfully submitted that this applied reference would have neither disclosed nor would have suggested such a metal-polishing liquid (for example, a dilution of the recited metal-polishing liquid material), including the oxidizing agent, oxidized-metal etchant and water, and also the protective film-forming agent and a dissolution promoter therefor. See claim 12.

In addition, it is respectfully submitted that the reference as applied by the Examiner would have neither taught nor would have suggested the additional features of the present invention directed to the metal-polishing liquid, as in claims 13-16 and 48-55, containing features discussed previously in connection with the claimed metal-polishing liquid material of claims 1-11 and 40-47.

Furthermore, it is respectfully submitted that these references as applied by the Examiner would have neither taught nor would have suggested such a method

for producing a metal-polishing liquid, or a polishing method using this liquid, as in various of the present claims, the liquid being formed through use of a liquid material including, inter alia, a protective film-forming agent and a dissolution promoter for the protective film-forming agent, the method including a step of diluting the metal-polishing liquid material with a diluent, for example, an aqueous solution, for dilution of at least one ingredient of an ingredient group consisting of an oxidizing agent, an oxidized metal-etchant, the protective film-forming agent and the dissolution promoter. See claim 18; note also claim 19.

Furthermore, it is respectfully submitted that the applied reference would have neither disclosed nor would have suggested the additional features of the method for producing a metal-polishing liquid as in various of the present claims, including wherein the diluent is water or an aqueous diluent solution (see claim 20); and/or wherein at least the protective film-forming agent and the dissolution promoter are included in the first constituent element (note claims 21 and 22); and/or temperature of the oxidizing agent and oxidizing agent-containing mixture during the mixing (see claim 23; note that by keeping the, e.g., oxidizing agent, such as hydrogen peroxide, at a temperature of at most 40°C, stability of the liquid is improved); and/or wherein at least a part of the protective film-forming agent is solid, having a mean particle size of at most 100 μm , and is dissolved or dispersed in the metal-polishing liquid in the mixing step (see claim 24).

In addition, it is respectfully submitted that the applied reference does not disclose, nor would have suggested, such a polishing method as in the present claims, including use of the metal-polishing liquid comprising, inter alia, the protective film-forming agent and dissolution promoter (see claim 25); and/or

wherein the polishing method includes, prior to the polishing step, a mixing step as recited in claim 26.

Furthermore, it is respectfully submitted that the applied reference would have neither disclosed nor would have suggested such liquid material or liquid, or such method of forming the liquid or such polishing method, as in the remaining claims, including (but not limited to) features as in claims 27-36.

The present invention is directed to a metal-polishing liquid material, metal-polishing liquid formed therefrom (for example, by adding a diluent thereto), and a method of forming such liquid and a method of polishing using such liquid.

With recently developed microfabrication techniques for large scale integrated circuits, chemical mechanical polishing (CMP) has been developed, e.g., for microfabricating copper alloy wirings and interconnections. One general method of CMP of metal includes sticking a polishing pad on a circular platen, soaking it in a metal-polishing liquid, setting a substrate having a metal film formed thereon to the polishing pad to keep the metal film in contact with the pad, and rotating the platen while a predetermined pressure is applied to its back to thereby remove the excess (projecting) metal film owing to the mechanical friction between the polishing liquid and the projecting areas of the metal film. The metal-polishing liquid for CMP generally includes an oxidizing agent and solid abrasive grains, optionally containing an oxidized-metal etchant and a protective film-forming agent. A basic mechanism of the CMP is described in the paragraph bridging pages 2 and 3 of Applicants' specification.

Various problems arise in connection with use of conventional CMP. Some of these problems are due to the abrasives commonly used. Others arise in

connection with costs in transporting and storing the metal-polishing liquids, since most of this liquid is water and the liquid requires a large space.

Problems in connection with storing and transporting relatively large amounts of the metal-polishing liquid can be solved when a concentrate of the metal-polishing liquid can be prepared, as described in the paragraph bridging pages 4 and 5 of Applicants' specification.

Moreover, as a further technique for CMP, there has been proposed a method of using a metal-polishing liquid that includes aminoacetic acid, for example, glycine, or amidosulfuric acid serving as an oxidized-metal etchant, and benzotriazole serving as a protective film-forming agent. However, in proposed techniques, since solubility in water of the benzotriazole is low, metal-polishing liquids as discussed in this paragraph could not be concentrated into concentrates sufficient to have advantages in transporting and storing the concentrate.

Against this background, Applicants provide a metal-polishing liquid material, and metal-polishing liquid formed therefrom, which can include a protective film-forming agent such as benzotriazole, and yet which can be formed as an advantageous concentrate having advantages, e.g., in transporting and storing the liquid material. Applicants have found that by including a dissolution promoter for the protective film-forming agent in the liquid material and liquid, the desired concentrate can be achieved. Moreover, it is easy to prepare the metal-polishing liquid from, for example, the liquid material according to the present invention, by diluting the material with, e.g., water and/or an aqueous solution, and optionally adding thereto any additional ingredients. Note the paragraph bridging pages 6 and

7 of Applicants' specification. Note also the first full paragraph on page 7 of Applicants' specification.

Accordingly, by the present invention, using, inter alia, the dissolution promoter, together with the protective film-forming agent and, e.g., oxidized-metal etchant, the metal-polishing liquid material having a high concentration can easily be provided, and a metal-polishing liquid according to the present invention can be readily prepared from this liquid material by adding, e.g., a diluent. The liquid material, having a high concentration, has advantages in that the costs for producing the liquid can be reduced, capacity of tanks for transporting the liquid can be reduced, and capacity of the tanks for storing, transporting and using the liquid in polishing plants can be reduced. Moreover, by including the dissolution promoter, material for the metal-polishing liquid may have a broader and higher concentration, providing greater flexibility of polishing capabilities of the liquid. See page 51, lines 6-17 of Applicants' specification.

It is to be emphasized that, different from conventional polishing agents, a metal-polishing liquid material having a protective film-forming agent, with a high concentration, can be easily and effectively formed; and the metal-polishing liquid of the present invention is readily prepared from the metal-polishing liquid material having a high concentration by diluting the material, and therefore its advantages are that the costs for producing the metal-polishing liquid can be reduced, the capacity of the tanks for transporting the liquid can be reduced, and the capacity of the tanks for storing, transporting and using the liquid and the liquid material in polishing plants can be reduced. Thus, according to the present invention, the dissolution promoter is added for essentially increasing the solubility in, e.g., water, of the

protective film-performing agent. Accordingly, the material for the metal polishing liquid may have a broader and higher concentration, in accordance with the polishing capabilities of the liquid. Note, for example, page 9, lines 12-23 of Applicants' specification.

Sasaki, et al. discloses a polishing agent for use in a microprocessing step such as a semiconductor device manufacturing step, and a polishing method using such polishing agent. The method includes steps of forming a film made of material containing a metal as a main component on a substrate having depressed portions on the surface so as to fill the depressed portions with the film; and polishing the film by a chemical mechanical polishing method using a polishing agent containing a chemical agent responsible for forming a protective film on the surface of the film by reacting with the material containing a metal as a main component, thereby forming a conductive film in the depressed portion. Note the paragraph bridging columns 1 and 2 of this patent. This patent further discloses that the polishing agent includes a chemical agent responsible for forming a protection film on the surface of the substrate to be polished by reacting with the material containing a metal as a main component. See column 2, lines 7-15 of this patent. Note also column 3, lines 38-54 of this patent, describing chemical agents forming a protection film, these chemical agents including benzotriazole. Note also the paragraph bridging columns 3 and 4 of this patent, disclosing that the polishing agent also includes an etching agent for the material containing a metal as a main component. Note, further, column 4, lines 50-53 of this patent, disclosing a preferred polishing agent that contains an aminoacetic acid and/or an amidosulfuric acid, an oxidizing agent,

water and benzotriazole or a derivative thereof. Note also column 5, lines 4-16; and column 8, lines 11-39, of this patent.

Sasaki, et al., goes on to describe, in Example 4 and in connection with Fig. 13, a polishing apparatus used in the polishing method described in the patent. In this polishing apparatus, a coolant circulation path 41 is provided to the polishing table 14. In the coolant circulation path 41, a coolant such as water or ethylene glycol is allowed to flow to control the temperature of the polishing table 14 and a polishing path 13. The coolant path 41 is connected to two coolant cooling device systems (cooling device 42 and 43), and the route of coolant circulation can be changed any time by a switch 44. In addition, cooling agent supply systems 45 and 46 are connected to the cooling devices 42 and 43 respectively to control the temperature of the polishing agent to be supplied. Note, col. 12, lines 49-67 of Sasaki, et al.

It is respectfully submitted that Sasaki, et al. would have neither taught nor would have suggested such liquid material or such liquid, or such method of forming the liquid or of polishing using such liquid, as in the present claims, including, inter alia, wherein the liquid material includes the dissolution promoter for the protective film-forming agent, in particular, includes this dissolution promoter and the protective film-forming agent.

On page 12 of the Office Action mailed October 31, 2003, in lines 4 and 5 under the heading "Response to Arguments", the Examiner contends that hydrogen peroxide was not intended to anticipate the "dissolution promoter" substance claimed in the present claims. It is respectfully suggested that this position taken by the Examiner on page 12 is inconsistent with the following quoted material on

page 2 of this Office Action mailed October 31, 2003, in reference to claim 1,
wherein the Examiner states:

“Sasaki teaches a metal-polishing liquid material comprising... a dissolution promoter for the protective film-forming agent (hydrogen peroxide)...”

In any event, from the Examiner's position on page 12 of the Office Action mailed October 31, 2003, the Examiner is expressly abandoning any position that hydrogen peroxide constitutes a “dissolution promoter” substance as in the present claims.

Rather, the Examiner contends on page 12 of this Office Action mailed October 31, 2003, that ethers (ethylene glycol) are considered to anticipate the dissolution promoter set forth in the present claims, the Examiner referring to col. 12, lines 27-36 and lines 50-55 of Sasaki, et al.

However, col. 12, lines 50-55 of Sasaki, et al. refer to a coolant such as water or ethylene glycol flowing in a coolant circulation path 41, which is a separate path from the polishing agent. This is clearly seen in Fig. 13 and the description in connection therewith at col. 12, lines 62-65, that the polishing agent supply systems 45 and 46 are connected to the cooling devices 42 and 43 respectively to control the temperature of the polishing agent to be supplied. It is respectfully submitted that the coolant such as water or ethylene glycol is in a separate path from the path of the polishing agent, passing by the polishing agent in heat exchange relationship. Clearly, Sasaki, et al., in connection with Example 4 and Fig. 13, would have neither disclosed nor would have suggested, and in fact would have taught away from, a polishing agent containing ethylene glycol, as alleged by the Examiner.

The Examiner has also referred to col. 12, lines 27-36 of Sasaki, et al., in connection with ethers (ethylene glycol) in Sasaki, et al. Col. 12, lines 27-36 of Sasaki, et al. discloses use of an agent capable of forming a chelate compound or a complex with the film material to be etched. Various materials are listed at col. 12, lines 27-36, but it is respectfully submitted that these materials neither disclose nor would have suggested a dissolution promoter as in the present claims, including, in particular, ethers (ethylene glycol) as alleged by the Examiner.

To put it simply, it is respectfully submitted that, as alleged by the Examiner, the Examiner has provided no evidence or reasoning that the polishing agent and polishing method of Sasaki, et al., would have disclosed, or would have suggested, the liquid material, the liquid and methods as in the present claims, including the protective film-forming agent and the dissolution promoter for the protective film-forming agent. For this reason alone, it is respectfully submitted that the prior art rejection of all claims presently in the application, as set forth in the Office Action mailed October 31, 2003, is improper and must be withdrawn.

With reference to claims 4 and 5, on page 3 of the Office Action mailed October 31, 2003, the Examiner contends that Sasaki, et al., teaches wherein the dissolution promoter is a surfactant, and teaches wherein the surfactant is at least one of esters (aqueous glycerine solution, referring to col. 11, lines 25-30 of Sasaki, et al.) and ethers (ethylene glycol referring to col. 12, lines 27-36 and 50-55 of Sasaki, et al.). This Request For Reconsideration has already addressed and established that Sasaki, et al. discloses ethylene glycol as a coolant, not as part of the polishing agent.

Moreover, it is respectfully submitted that at col. 11, lines 25-30, Sasaki, et al. discloses a polishing agent having dispersed silica grains in a mixed solution (Cu etching solution) of 0.12 mole/l aqueous glycine solution and 0.44 mole/l aqueous hydrogen peroxide solution, followed by adding 0.001 mole/l benzotriazole ($C_6H_5N_3$) serving as a chemical agent thereto. That is, this polishing agent at col. 11, lines 25-30 of Sasaki, et al. includes glycine, not glycerin. As can be appreciated, glycine is an amino acid, and it is respectfully submitted that the solution including glycine would have neither taught nor would have suggested the liquid material or liquid as in the present claims, having esters or ethers (and clearly would have neither disclosed nor would have suggested such liquid or liquid material having an aqueous glycerine solution, as alleged by the Examiner).

The contention by the Examiner in the paragraph bridging pages 12 and 13 of the Office Action mailed October 31, 2003, that "the name of the game is the claim", is noted. It must be emphasized, however, that in order to establish anticipation, the Examiner must show each recitation of the present claims is described as part of the polishing agent in Sasaki, et al., with description of forming of such agent and of using such agent as in the present method claims. That is, again referring specifically to the present claims, the Examiner must establish a liquid material or liquid including, inter alia, a dissolution promoter for the protective film-forming agent. It is respectfully submitted that the Examiner has not accomplished this, from the teaching of Sasaki, et al. It is respectfully submitted that Applicants have focused on distinctions between the present claim language and the teachings of Sasaki, et al., and based on such differences have clearly established that Sasaki, et al. would not have taught, nor would have suggested, the presently claimed

subject matter, including, inter alia, the dissolution promoter for the protective film-forming agent, as part of the liquid material and of the liquid of the present claims; or the method of forming the metal-polishing liquid and of using the metal-polishing liquid (that is, the polishing method), as in the present claims.

Furthermore, it is respectfully submitted that Sasaki, et al. is concerned with the polishing agent (that is, the polishing liquid) as a whole, and a polishing method using this agent. It is respectfully submitted that this reference does not disclose, nor would have suggested, the problems in connection with transport and storage of the polishing agent, and does not discuss concentrates; and it is respectfully submitted that this reference does not disclose, nor would have suggested, such method as in the present claims, including use of the diluent, and/or wherein various ingredients of the liquid material/liquid are provided in an unmixed state.

The Examiner points to col. 4, lines 1-5 of Sasaki, et al., as disclosing a method including a step of diluting the metal-polishing liquid material with a diluent. It is respectfully submitted that col. 4, lines 1-5 of Sasaki et al. discloses an etching agent containing an aminoacetic acid such as glycine, amidosulfuric acid or mixed acids of these compounds, and an oxidizing agent such as hydrogen peroxide, nitric acid, hypochlorous acid or ozone water may be used. Thus, the portion of col. 4 referred to by the Examiner describes an etching agent; and basis for the contention by the Examiner that this portion of Sasaki, et al. discloses a diluent, or, more particularly, discloses a step of diluting, is not seen. Applicants specifically traverse the conclusion by the Examiner that Sasaki, et al. teaches a method including a step of diluting with a diluent.

Again, it is emphasized that according to the present invention, including incorporation of the dissolution promoter for the protective film-forming agent, various advantages are achieved by the present invention, in connection with, e.g., ability to achieve a concentrate, such that costs in connection with storing, transporting and producing the metal-polishing liquid material and/or metal-polishing liquid can be reduced. Particularly, in view of these advantages, it is respectfully submitted that Sasaki, et al. would have either disclosed nor would have suggested the present invention as presently claimed.

Contrary to the conclusion by the Examiner in the first two lines on page 4 of the Office Action mailed October 31, 2003, it is respectfully submitted that Sasaki, et al. would have neither disclosed nor would have suggested a part of the protective film-forming agent being solid and having a mean particle size of at most 100 μm . Column 11, lines 25-65 of Sasaki, et al. discloses silica grains (polishing grains) having a specific size, in the polishing agent. Clearly, the silica grains are abrasive grains in the polishing agent in Sasaki, et al.; and such disclosure would have neither taught nor would have suggested wherein at least a part of the protective film-forming agent is solid, much less that a part of such agent has a mean particle size as in various of the present claims.

In addition, attention is respectfully directed to various of the present claims, reciting specific materials for the protective film-forming agents, and for solvents and/or surfactants of the dissolution promoter. Particularly in connection with these claims, the disclosure of Sasaki, et al. would have neither taught nor would have suggested the presently claimed invention.

The Information Disclosure Statement submitted February 2, 2004, in connection with the above-identified application, is noted. It is respectfully submitted that this Information Disclosure Statement satisfied all applicable requirements of 37 CFR §1.97 and §1.98, at the time of filing such Information Disclosure Statement; and consideration of the document listed on the Form PTO-1449 thereof is respectfully requested. If this Information Disclosure Statement submitted February 2, 2004, is not in the file of the above-identified application at the time that the Examiner takes up this Request For Reconsideration, the Examiner is respectfully requested to contact the undersigned for a copy of this aforementioned Information Disclosure Statement. The Examiner is thanked in advance for cooperating with this request, as necessary.

In view of the foregoing, entry of these Remarks, reconsideration and withdrawal of the rejection set forth in the Office Action mailed October 31, 2003, and reconsideration and allowance of all claims remaining in the application, with the application thereafter being passed to issue in due course, are respectfully requested.

To the extent necessary, Applicants petition for an extension of time under 37 CFR §1.136. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to the Antonelli, Terry, Stout & Kraus,

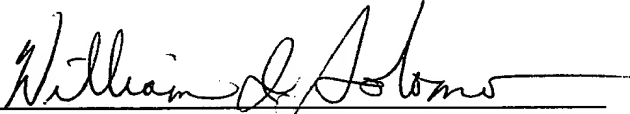
Application No.: 09/869,347

Docket No.: 566.40319X00

LLP, Deposit Account No. 01-2135 (Docket No. 566.40319X00), and please credit any excess fees to such Deposit Account.

Respectfully submitted,

ANTONELLI, TERRY, STOUT & KRAUS, LLP

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396.40288X00

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants: OHKOSHI et al.

Patent No.: 6,500,347

Issued: December 31, 2002

For: PROCESS FOR RECOVERING CRYSTALS FROM A SLURRY

CITATION OF PRIOR ART IN PATENT FILES

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

March 31, 2004

Sir:

Submitted herewith please find an Official Action in a Taiwanese application corresponding to the above-identified application, together with copies of documents cited in this Official Action. Also enclosed is a Form, substantially equal to Form PTO-1449, listing the submitted documents cited in this Official Action. These documents are being submitted for entry of record in the file of the above-identified U.S. Patent.

Entry of the enclosed documents, in due course, is respectfully requested.

Please charge any shortage in the fees due in connection with the filing of this paper, including extension of time fees, to the deposit account of Antonelli, Terry, Stout & Kraus, LLP, Deposit Account No. 01-2135 (Case: 396.40288X00), and please credit any excess fees to such deposit account.

Respectfully submitted,

William I. Solomon
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Attachments